

## A New Callionymid Fish, *Synchiropus kiyoeae*, from the Izu Islands, Japan

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**Abstract** *Synchiropus kiyoeae* sp. nov. is described on the basis of 20 specimens from Miyake-jima and Hachijo-jima, Izu Islands, Japan, and compared with allied species. Comments on the ecology of the new species are included.

The dragonets (Teleostei: Callionymidae) are a group of benthic fishes widely distributed in tropical and temperate seas. *Synchiropus*, the largest genus in the family, was originally described by Gill (1860). Fricke (1981), in his revision of the genus, recognized 26 valid species in four subgenera. Fricke included the three pygmy species of *Synchiropus* (*S. postulus* Smith, 1963, *S. minutulus* Fricke, 1981, and *S. laddi* Schultz, 1960) in the *postulus* species group of the subgenus *Synchiropus*. Members of this group do not exceed a standard length (SL) of 25 mm. A fourth species in this complex was recently discovered from the Izu Islands, Japan. This new species is described, illustrated, and compared with allied species in the present paper.

### Methods and materials

Methods follow those used in Fricke (1981). The preopercular spine formula is shown in the following scheme:  $a\frac{b}{c}d$ , when "a" is the number of antrorse spines at the base, "b" is the number of points or serrae at the dorsal margin, "c" is the number of points or serrae at the ventral margin, and "d" is 1 and means the main tip. The formula shows a simplified left spine. Right spines are annotated as if they were left.

Lengths are self-explanatory, except the following: head length is measured from the tip of the snout (middle of upper lip), but not from the tip of the premaxillary, to the anterior margin of the left gill opening. Predorsal (1) length is the distance between the tip of snout and the base of the first spine of the first dorsal fin. Predorsal (2) length is the distance between the tip of the snout and the base of the first ray of the

second dorsal fin. Preanal fin length is the distance between the tip of the snout and the base of the first anal fin ray.

Repositories of type specimens of the new species are as follows: The Australian Museum, Sydney (AMS); British Museum (Natural History), London (BM(NH)); Muséum National d'Histoire Naturelle, Paris (MNHN); Department of Zoology, National Science Museum, Tokyo (NSMT-P); Rhodes University, J. L. B. Smith Institute of Ichthyology, Grahamstown, South Africa (RUSI); Tatsuo Tanaka Memorial Biological Station, Miyake-jima, Japan (TMBS); National Museum of Natural History, Smithsonian Institution, Washington, D. C. (USNM); Academy of Sciences of the USSR, Zoological Institute, Leningrad (ZIL); Zoologisches Institut und Zoologisches Museum, Universität Hamburg (ZIM); Department of Zoology, University of Tokyo, University Museum, Tokyo (ZUMT).

### *Synchiropus (Synchiropus) kiyoeae* sp. nov.

(New Japanese name: Hime-teguri)

(Figs. 1~2)

**Material examined.** **Holotype:** USNM 257078, male, 22.9 mm SL, Toga Bay, Miyake-jima, Japan, 34°06'N, 139°28'E, 5~13.5 m, M. J. Zaiser, H. P. A. Sweatman and J. T. Moyer, 26 July 1982. **Paratypes:** MNHN 1983-3, 1 male (22.0 mm SL) and 1 female (14.2 mm SL), with same data as the holotype. AMS I.23508, 1 male (16.5 mm SL) and 1 female (16.3 mm SL), with same data as the holotype. BM(NH) 1983.3.3.1, 1 male (22.1 mm SL), Igaya Bay, Miyake-jima, J. Shepard, Aug. 1977. BM(NH) 1983.3.3.2, 1 female (20.9 mm SL), with same data as the holotype. USNM 232249, 1 female, 21.3 mm SL, Toga Bay, Miyake-jima, 5 m, P. E. Hadley, 10 July 1977. TMBS 820808, 1 male (23.8 mm SL)

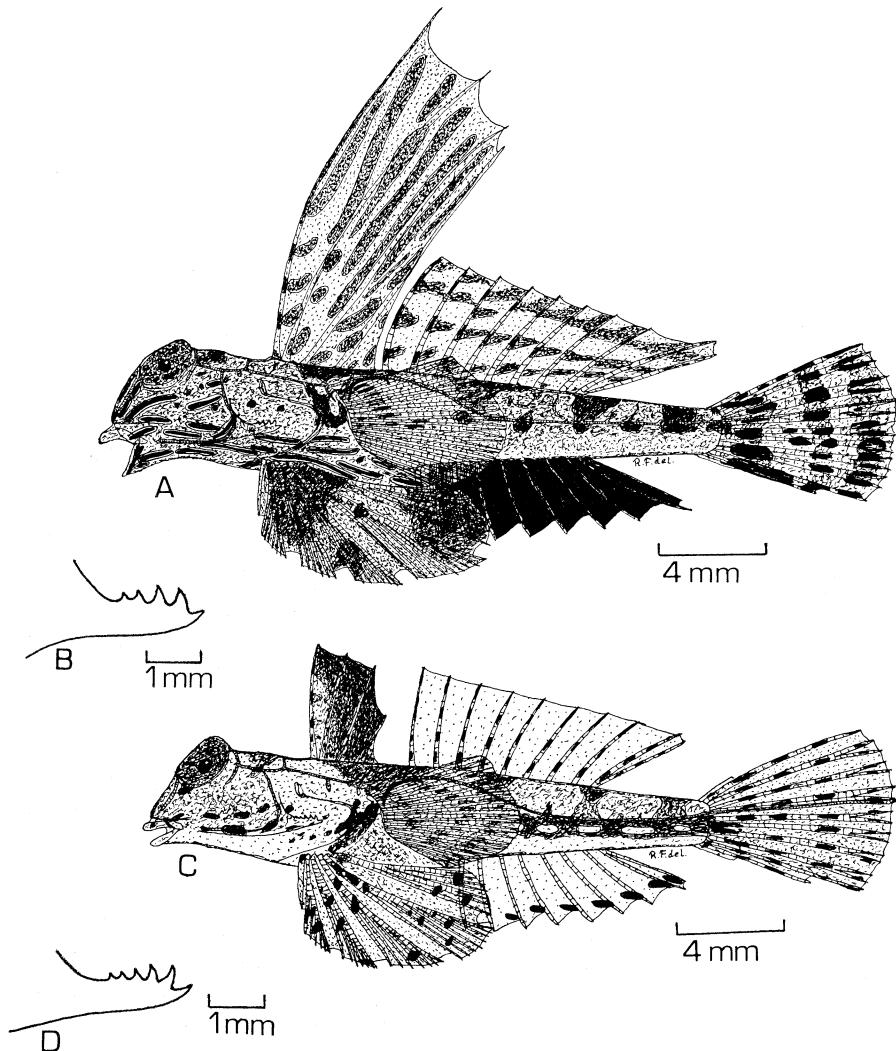


Fig. 1. *Synchiropus kiyoae* sp. nov., USNM 257078, holotype, male, 22.9 mm SL, Toga Bay, Miyake-jima, Japan: A, lateral view; B, left preopercular spine. BM(NH) 1983.3.3.2, paratype, 1 female, 20.9 mm SL, Toga Bay, Miyake-jima, Japan: C, lateral view; D, left preopercular spine.

and 1 female (22.8 mm SL), Sabigahama, Miyake-jima, 8.5 m, M. J. Zaiser, J. T. Moyer and S. Mizuno, 8 Aug. 1982. RUSI 17926, 1 male, 21.2 mm SL, Igaya Bay, Miyake-jima, 5~7 m, M. J. Zaiser and R. Fricke, 5 Oct. 1982. RUSI 17927, 1 female, 21.3 mm SL, Igaya Bay, Miyake-jima, 13.5 m, M. J. Zaiser and J. T. Moyer, 28 July 1982. NSMT-P 21714, 1 male, 22.6 mm SL, with same data as RUSI 17926. NSMT-P 21713, 1 female, 15.4 mm SL, Toga Bay, Miyake-jima, 5~13.5 m, M. J. Zaiser, 26 July 1982. ZIL 46504, 1 female, 20.0 mm SL, with same data as RUSI 17927. ZIM 6453, 1 female, 18.4 mm SL, with same data as RUSI 17927. ZUMT

42861~42863 and 42881, 3 males (17.6~24.0 mm SL) and 1 female (14.9 mm SL), Hachijo-jima, Izu Islands, Japan, 33°04'N, 139°50'E, Sekiyama, Sep. 1922.

**Diagnosis.** A *Synchiropus* of the *postulus* species group with 4 spines in the first dorsal fin, 9 rays in the second dorsal fin, 8 (rarely 7) rays in the anal fin, a preopercular spine formula of  $\frac{(3\sim)4\sim5}{-}1$ , a large pelvic fin with the longest ray reaching to base of 3rd to 5th anal fin ray, a first dorsal fin in the male with all spines

Table 1. Proportions of the holotype and paratypes of *Synchiropus kiyooe* sp. nov. from the Izu Islands, Japan (expressed as hundredths of SL).

	Holotype (male)	Paratypes (males)		Paratypes (females)
	Miyake-jima	Miyake-jima	Hachijo-jima	Miyake-jima
Predorsal (1) length	27.29	25.90~33.33	34.17~38.92	29.66~36.81
Predorsal (2) length	44.54	42.31~51.92	50.00~55.11	45.23~51.10
Preanal fin length	52.40	49.00~54.28	53.75~57.39	52.98~58.68
Prepelvic fin length	26.20	24.96~28.57	30.42~35.80	23.38~29.04
Head length	25.33	22.29~32.33	27.04~29.58	25.82~34.22
Body depth	17.90	16.49~19.96	17.17~18.75	14.59~20.31
Body width	19.65	18.54~23.64	18.46~22.08	18.96~24.84
Caudal peduncle length	18.78	16.72~20.39	17.60~20.42	16.87~21.58
Caudal peduncle depth	6.79	6.96~9.39	7.39~8.33	5.26~9.82
Caudal fin length	28.38	27.72~30.87	31.25~32.95	26.45~32.06
Eye diameter	9.61	10.24~11.84	11.59~13.64	10.33~12.88
First D <sub>1</sub> spine length	64.19	49.09~60.12	29.54~57.50	11.20~23.94
Last D <sub>2</sub> ray length	23.80	19.71~27.21	18.75~24.17	16.02~19.14
Last A. ray length	18.56	13.42~19.73	21.03~21.67	13.34~18.96
Pectoral fin length	25.76	23.32~29.70	23.30~28.33	21.39~25.93
Pelvic fin length	40.18	33.11~39.83	32.95~35.19	35.65~42.72

elongate but scarcely filamentous, in the female with 1st to 3rd spines elongate and about as long as first ray of second dorsal fin, elongate spots and vertical lines on the first dorsal fin of the male, first dorsal fin mostly dusky in female, the second dorsal fin with dark spots, the anal fin black (male) or with a dark spot on each membrane (female), and dusky blotches on the pelvic fin.

**Description.** D<sub>1</sub>. IV; D<sub>2</sub>. viii, 1; A. (vi, 1~) vii, 1; P<sub>1</sub>. i, 17~21, i~ii (totally: 19~23); P<sub>2</sub>. I, 5; C. (i~ii), i, 7, ii, (i~ii). Proportions of the holotype and paratypes are shown in Table 1.

Body elongate and slightly depressed. Head slightly depressed (female), slightly compressed (male), 2.9~4.5 in SL. Body depth 4.9~6.9 in SL. Eye 2.1~3.2 in head. Interorbital distance 6.3~24.1 in head. Preorbital length 2.4~5.1 in head. Occipital region with a smooth bony plate. Branchial opening sublateral in position. Preopercular spine length 2.6~5.4 in head; preopercular spine with a slightly upcurved main tip, a smooth slightly convex ventral margin, no antrorse spine at its base, and four to five (rarely three) upcurved or slightly recurved points at its dorsal margin (formula:

$\frac{(3\sim)4\sim5}{-}1$ ; see Fig. 1 B, D). Urogenital papilla in the male elongate, 5.8~23.7 in head, in the female smaller, more than 17.2 in head or not

visible. Lateral line reaching from preorbital region to end of third branched caudal fin ray (counted from above), with a short suborbital and a long preoperculo-mandibular branch, two ventral branches before the pectoral fin base, and a number of short dorsal branches along the sides of the body; the lines of the opposite sides are interconnected by a commissure across the occipital region. Caudal peduncle length 4.6~6.0 in SL. Caudal peduncle depth 10.1~17.1 in SL. Maximal observed 24.0 mm SL in the male, 22.8 mm in the female.

First dorsal fin very high in the male, first to fourth spines elongate but nearly not filamentous, first spine 0.4~1.0 in head, second spine 0.45~0.6 in head, third spine 0.49~0.60 in head, and fourth spine 0.54~0.93 in head. First dorsal fin high in the female, first to third spines elongate, usually a little higher than the first ray of the second dorsal fin, first spine 1.08~2.8 in head, second spine 1.1~1.8 in head, third spine 1.15~1.7 in head, and fourth spine 2.3~2.9 in head. Predorsal (1) length 2.57~3.86 in SL. Second dorsal fin distally straight, first ray in the male 1.0~2.0 in head, in the female 1.3~2.1 in head. Last ray slightly elongate, in the male 0.88~1.54 in head, in the female 1.38~2.14 in head. Predorsal (2) length 1.81~2.24 in SL. Anal fin beginning on a vertical through

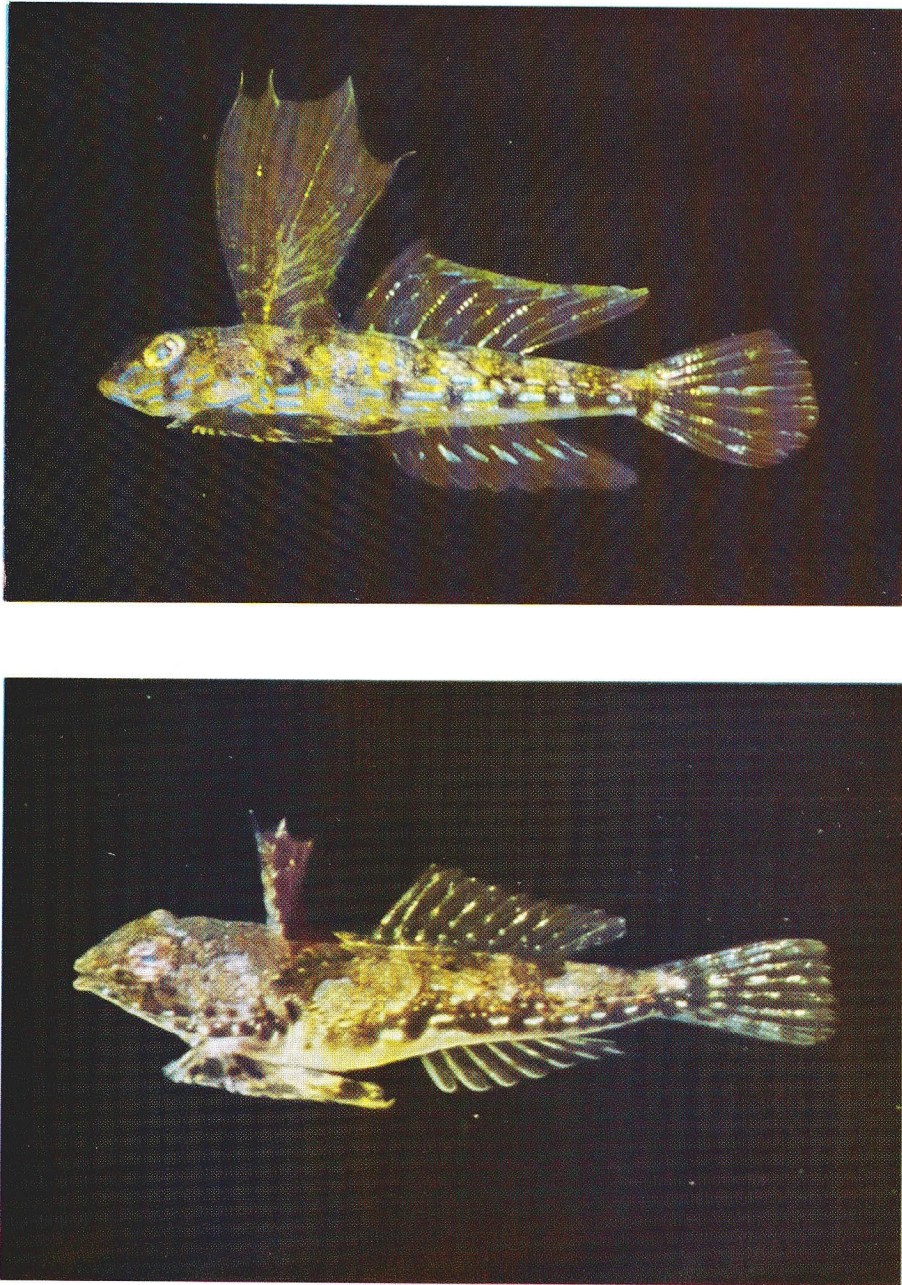


Fig. 2. *Synchiropus kiyoe* sp. nov., Toga Bay, Miyake-jima, Japan. Male (above) and female (below). From Ektachrome transparencies by M. J. Zaiser.

third or fourth ray of second dorsal fin. Last anal fin ray in the male 1.29~1.71 in head, in the female 1.63~2.57 in head. Preanal fin length 1.70~2.04 in SL. Pectoral fin distally convex, reaching to about third or fourth anal fin ray when laid back. Pelvic fin very large, distally convex, reaching to base of third or fourth membrane of anal fin when laid back. Pelvic fin length 0.60~0.88 in head. Prepelvic fin length 2.79~4.28 in SL. Caudal fin distally convex. Caudal fin length 3.0~3.8 in SL.

Color in life. See Fig. 2.

Color in alcohol. Head and body brown, with dark brown saddles and spots, ventral parts in the female whitish, thorax in the male with a dark brown blotch. Preorbital region, cheeks, operculum, and base of pelvic fin in the male with ocellate dark streaks. Sides of body behind pectoral fin base in the female with a curved dark brown streak. Eye brown. First dorsal fin in the male light brown, with darker spots (ventrally) and vertical streaks (distally) on the membranes; in the female blackish except for the basal two-thirds of the first membrane which are light, with some darker spots. In female specimens which had been in preservative for some years, the first dorsal fin is mostly light with a distal dusky margin. Second dorsal fin with about four dark spots on each fin ray, in the male with 3~4 rows of dusky blotches on the membranes, membranes in the female translucent. Anal fin blackish in the male, translucent in the female, with a distal black spot on each membrane. Pectoral fin with irregular dark spots. Pelvic fin in the male with a basal and two distal dark areas, in the female with rows of dark spots. Caudal fin with 3~4 vertical rows of dark spots.

**Sexual dimorphism.** Males have a higher first dorsal fin than females, with different fin ray proportions (4th spine longer), a longer last ray of the second dorsal fin and anal fin, a usually longer urogenital papilla, and a different color pattern of the first dorsal fin, second dorsal fin, anal fin, pectoral fin, caudal fin, and of the head.

**Distribution.** This new species is known only from the Izu Islands, Japan: from the type locality, Miyake-jima, and from Hachijo-jima. The species has been collected at depths between 5 and 13.5 meters.

**Ecological notes.** Compared to other callionymid fishes, *Synchiropus kiyoeae* inhabits an

unusually wide variety of substrate types. At Miyake-jima, it has been found on coarse sand, broken shells, volcanic gravel, amongst small rocks, and under accumulations of dead algae. Frequently, it was observed to flee, when under stress, to areas of solid lava substrate with numerous small crevices and algal cover.

Individuals of *S. kiyoeae* are site-attached. Courtship and spawning occur daily near dusk, with each male mating with several females. The sexually dimorphic first dorsal fin plays an important role in courtship displays, as does a temporary intensification of male-specific colors. Adult pairs rise slowly off the substrate during spawning, releasing their gametes in the water column. The rapid dash to the substrate following gamete release differs from the slow descent of the callionymid fish *Diplogrammus xenicus* (Zaiser, MS).

*S. kiyoeae* suffers high mortality at Miyake-jima in the late summer and early autumn, partially due to the regular occurrence of typhoons at that time of year. The abundance of the species each spring followed by the dramatic depletion of the population by autumn suggests that an annual turnover of a high percentage of *S. kiyoeae* in an area may be possible.

**Etymology.** *Synchiropus kiyoeae* is named in honor of Mrs. Kiyoe Tanaka, widow of the late Dr. Tatsuo Tanaka, who generously donated land, facilities, and her personal time for the establishment and maintenance of TMBS.

**Relationships.** *Synchiropus kiyoeae* differs from *S. postulus* Smith (Smith, 1963: 560, fig. 7, pl. 86E, East Africa; Fricke, 1981: 116~118, fig. 37, Cargados Carajos) by a first dorsal fin with different spine proportions (*S. kiyoeae*: 1st spine longest, 4th spine nearly as long as 3rd spine; *S. postulus*: 2nd and 3rd spines longer than 1st, 4th spine much shorter than 3rd), a different color pattern, and, in the male, first dorsal fin nearly without filaments, a different pelvic fin shape (concave in *S. postulus*, convex in *S. kiyoeae*), a different color pattern of the second dorsal fin (*S. kiyoeae* male: horizontal dark streaks; *S. postulus* male: transverse dark streaks), of the anal fin (*S. kiyoeae*: black in the male, with a distal black blotch on each membrane in the female; *S. postulus*: posterior part dusky in the male, rest of fin translucent, fin totally translucent in the female), pelvic fin, pectoral



fin, caudal fin, the head and of the body. It can be distinguished from *Synchiropus minutulus* Fricke (1981: 119~123, fig. 38, Maldive and Chagos archipelagos) by the different proportions of the spines of the first dorsal fin (see comparison between *S. kiyoae* and *S. postulus*), a shorter pectoral fin, and a different color pattern of all fins (*S. minutulus*: fins translucent except first dorsal fin distally dusky, anal fin posteriorly dusky, and caudal fin with three vertical dark streaks), the head, and the body, and from *S. laddi* Schultz (Schultz, 1960: 406~409, fig. 131, Bikini, Rongelap, Rongerik and Enewetak atolls; Fricke, 1981: 124~126, fig. 39, Palau, Tuamotu) by different proportions of the rays of the first dorsal fin (see comparison between *S. kiyoae* and *S. postulus*), a higher first dorsal fin in the female, and a different color pattern of all fins (translucent in *S. laddi*), the head, and the body.

From other species of the genus *Synchiropus*, the new species differs by the characters of the *postulus*-group (fin formulae  $D_2$ . viii, 1 (or 9), A. vii, 1, a preopercular spine formula of  $\frac{(3 \sim 5)}{1}$  and a small body size, in combination with a very high first dorsal fin in the male and a low fin in the female).

**Discussion.** *Synchiropus kiyoae* belongs to the *postulus*-group of the genus *Synchiropus*. Nakabo (1982: 94~95, fig. 9) used the generic name *Minysynchiropus* for this group. However, he failed to sufficiently distinguish this genus from *Synchiropus* and referred only to "osteological evidence". Nakabo (1983) compared osteological features of callionymid fishes, but did not give evidence or even diagnoses for his generic system. Therefore, we cannot follow his view and use the generic name *Synchiropus* (as defined by Fricke, 1981) for the new species.

Nakabo (1982: 95) synonymized the species *Synchiropus postulus* and *S. minutulus* with *S. laddi*, recognizing only "*Minysynchiropus laddi*" as valid, without specific reasons. We maintain that the three species can be clearly distinguished by the features given by Fricke (1981: 25, 122~123, 126).

The "juvenile *Diplogrammus goramensis*" described and illustrated by Ochiai (1963: 69~70, fig. 2) from Amami Island, Japan, is a *Synchiropus* of the *postulus*-group and may belong to this

new species. But according to T. Nakabo (personal communication), Ochiai's specimen has been lost. The description and illustration in Ochiai (1963) are not sufficient to identify the specimen.

#### Acknowledgments

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#### Literature Cited

- Fricke, R. 1981. Revision of the genus *Synchiropus* (Teleostei: Callionymidae). J. Cramer, Braunschweig, 194 pp.
- Gill, T. N. 1860. On the genus *Callionymus* of authors. Proc. Acad. Nat. Sci. Philad., 1859 (1860): 128~130.
- Nakabo, T. 1982. Revision of the genera of the dragonets (Pisces: Callionymidae). Publ. Seto Mar. Biol. Lab., 27 (1/3): 77~131.
- Nakabo, T. 1983. Comparative osteology and phylogenetic relationships of the dragonets (Pisces: Callionymidae) with some thoughts of their evolutionary history. Publ. Seto Mar. Biol. Lab., 28 (1/4): 1~73.
- Ochiai, A. 1963. Two dragonet fishes obtained from the tidal zone of the Amami Islands. Bull. Misaki Mar. Biol. Inst., Kyoto Univ., (4): 63~74.
- Schultz, L. P. 1960. Family Callionymidae, pp. 397~410. In Schultz, L. P. et al., Fishes of the Marshall and Marianas Islands, 2. Bull. U. S. Nat. Mus., 202 (2): i~ix+1~438, pls. 75~123.
- Smith, J. L. B. 1963. Fishes of the families Draconettidae and Callionymidae from the Red Sea and Western Indian Ocean. Rhodes Univ. Ichthyol. Bull., (28): 547~564, pls. 83~86.

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伊豆諸島産ネズボ科魚類の 1 新種ヒメテグリ *Synchiropus kiyoae*

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三宅島および八丈島からネズボ科魚類の 1 新種ヒ

メテグリ *Synchiropus kiyoae* が 20 個体採集された。本種は *Synchiropus postulus* group に属するが, *postulus* group の他の 3 種, *S. postulus*, *S. minutulus*, *S. laddi* とは背鰭の形や体色斑紋のちがいにより区別される。なお, 本種の生息環境, 産卵行動についても言及した。

(Fricke: ドイツ連邦共和国; Zaiser: 100-12 東京都三宅村阿古 田中達男記念生物実験所)